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# USSR Report

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9 July 1985

USSR REPORT  
ENERGY

## CONTENTS

## FUELS

## COAL

Vostochnyy Mine Gets New Conveyor System (Yu. Razgulyayev; PRAVDA, 7 Mar 85).....	1
Methods for Solving Kuzbass Problems Proposed (M. Berkovich, V. Dolmatov; SOVETSKAYA ROSSIYA, 3 Mar 85).....	4
Kirghiz Coal Industry Development Viewed (A. Budnikov; SOVETSKAYA KIRGIZIYA, 16 Jan 85).....	8

## ELECTRIC POWER

## NUCLEAR POWER

Energy Minister Discusses Gorkiy AST, CEMA Plans (Yu. Sinyakov; SOVETSKAYA LATVIYA, 17 Mar 85).....	11
Plasma Physicist Views Fusion Reactor Feasibility (B. Kadomtsev Interview; KOMSOMOL'SKAYA PRAVDA, 21 Apr 85).....	14
Briefs	
Zaporozhye AES Progress	18
Kurskaya AES Progress	18
Chernobylskaya AES Status	18
Chernobyl AES Replaces Boiler	18

## NON-NUCLEAR POWER

Deputy Minister Discusses GRES Modernization, 1986-1990 (A.N. Makukhin; SOTSIALISTICHESKAYA INDUSTRIYA, 30 Mar 85).....	19
Ministry Conference Sets Heat, Energy Supply Organizational Goals (S. Ya. Belinskiy, et al.; ENERGETIK, No 3, Mar 85).....	21
CEMA Official Discusses Economics of Power Line to West (Pal Kovacs; EKONOMICHESKOYE SOTRUDNICHESTVO STRAN- CHLENOV SEV, No 11, Nov 84).....	24
Ukrainian GRES Modernizations, Stoppages Described (V. Zhmurko; EKONOMICHESKAYA GAZETA, No 8, Feb 85).....	28
Briefs	
Thermal Power Station Program	30
Magnetohydrodynamic Energy Transformation Research	30
Bureyskaya GES Under Construction	31
Hollow 60-Millimeter Wire Developed	31
New Surgut Power Unit	31
Sredneuralskaya GRES Fuel Savings	31

## GENERAL

USSR, CEMA Electric Power Production Surveyed (Yu. Savenko; PLANOVOYE KHOZYAYSTVO, No 1, Jan 85).....	32
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COAL

VOSTOCHNYY MINE GETS NEW CONVEYOR SYSTEM

Moscow PRAVDA in Russian 7 Mar 85 p 1

[Article by PRAVDA correspondent Yu. Razgulyayev from Pavlodar Oblast: "An Approaching Start"]

[Text] The Ekibastuzugol' [Ekibastuz Coal] Production Association is developing rapidly. At present, its mines send over 10 percent of all the fuel mined in the nation to the power plants of Siberia, the Urals and Kazakhstan. Soon the contribution of the young basin to the Power Program will be even greater. The socialist obligations of the Kazakh workers for 1985, as published in PRAVDA, envisage the early completion of the first stage of a new coal open pit, Vostochnyy, producing 15 million tons. The full capacity of this mine is 30 million tons a year. How are things going now at Vostochnyy?

"In terms of output the new mine is behind Bogatyr'," related the General Director of the Association, Hero of Socialist Labor, S. Kurzhey. "But for the first time in Soviet practices, the coal from Vostochnyy will move from the face to the surface directly in large conveyors. The new system will eliminate the main cause of stoppages in the giant rotary equipment, the unrhythmical delivery of railroad cars."

The construction of the new mine is still in full swing, but a black 30-m wall of coal has already been exposed. The integrated brigades from the Ekibastuz-shakhtostroy [Ekibastuz Mine Construction] Combine have already removed around 14 million m<sup>3</sup> of rock from here and this exposed the path to the coal reserves. Particularly distinguishing itself was the crew of drivers led by V. Andreyev: each shift it sent at least a thousand tons of dirt to the surface.

The first SRS(K)-2000 rotary excavator is ready. Specialists from the Kazprom-tekhmontazh [Kazakh Industrial Equipment Installation] Trust are now the most noticeable personnel at the site. Here everyone remembers how the brigade of Yu. Grishin prepared carefully to lower the 200-ton loading hopper into the mine. According to the plans it was to be assembled below, at the 30-m level. Just the delivery of the parts could require weeks and installation itself would have to be carried out under the difficult "field" conditions.

"We decided to assemble the entire unit on the surface, at a stationary site," stated the chief of the Ekibastuz Administration of the trust, A. Gusev. "This would greatly shorten the assembly time and improve the work quality."

The new method made it possible to also greatly shorten the time for installing the face conveyors on the floor of the pit as these stretched almost 2 km. With the aid of preassembled unit they are now installing the transloaders and the drive stations and the weight of one unit has been brought up to 400 tons. Work on the surface is also constantly increasing.

But still as a whole the construction pace cannot help but cause valid concern. Judge for yourselves. The Vostochnyy Mine has been under construction for 5 years already. During this time a little more than 70 percent of the estimated cost for the first installation has been used. Capacity for the first 7.5 million tons should be completed at the end of the second quarter, but plan fulfillment as before is lagging. For example, in January together with all the subcontractors, Ekibastuzshakhtostroy completed 1.5 million rubles of work instead of the planned 3. million. In February they worked better but the lag was virtually not reduced.

The construction of the loading points causes particular concern. This is the last link in the production chain but without it the entire line cannot be started up.

I have repeatedly been present at meetings between the construction workers, the clients and the subcontractors. I have always been amazed by the lack of coordination in their actions and the desire to shift the blame to the other party. Even the installation of cranes which are equally essential for all the construction participants at times develops into an unsolvable problem. The question is aided little by the constant mutual complaints between the client, the Ekibastuzgol' Association and the contractor, the Ekibastuzshakhtostroy Combine. Certainly they are all under the same ministry!

In this context I would like to add that in the opinion of the Ekibastuz workers, the USSR Ministry of Coal Industry itself in the given instance does not always set an example of professionalism and principledness. Its workers come here regularly, including the deputy ministers and the chiefs of the main administrations. Many documents are drawn up urging "acceleration" and "a fundamental change" but for now no significant changes can be seen.

Even last year, it became clear that the combine did not have enough of its own capacity to produce the reinforced concrete elements. The ministry adopted a decision to manufacture them at other enterprises in the sector. Everything had been figured out and scheduled. The months passed but not a single cubic meter of reinforced concrete was received by Ekibastuz and the construction of buildings and the installation of the power transmission lines began slowing down. Problems also remain with equipment deliveries. For example, they are still waiting for the Krasnoyarsk Sibtyazhmash [Siberian Heavy Machinery] Plant to manufacture the curing press as without it it is impossible to install the conveyor belts.

Days and weeks are flying by and less and less time remains until the starting up of the first stage of a major project of the five-year plan. Even this year

the Ekibastuz workers should produce at least 4 million tons of fuel here. But for this, aside from completing the construction and installation work, it is essential to test out complex equipment and set up a new production method for our coal industry. Finally, the personnel must be trained in operating the machines.

The tasks are not easy ones. In order to successfully cope with them we must overcome the lagging and make up for lost time. This can be done.

10272

CSO: 1822/211

COAL

METHODS FOR SOLVING KUZBASS PROBLEMS PROPOSED

Moscow SOVETSKAYA ROSSIYA in Russian 3 Mar 85 p 2

[Article by M. Berkovich, correspondent from the newspaper KUZNETSKIY RABOCHIY and V. Dolmatov, correspondent of SOVETSKAYA ROSSIYA: "A Drawn Out Experiment"]

[Text] The materials on the problems of Kuznetsk coal ("Difficult Seams" in SOVETSKAYA ROSSIYA, 5-6 January 1985) evoked a concerned response from the miners of the Kuzbass [Kuznetsk Basin]. The readers have proposed new subjects and shared their ideas and this obliges us to continue the conversation.

The hydraulic mine externally differs from a conventional one. There are none of the customary mounds of coal. And if you go underground, it is like a miracle with water rushing and bubbling everywhere. Here the water is a great worker as a powerful jet from the monitor shatters the coal wall, carries the coal off to the hydraulic chamber, lifts it to the surface and delivers it by pipe to the processing mill.... The first testing of hydraulic mining occurred in prewar times but the present success came in the 1970's, when the Kuzbass Yubileynaya Hydraulic Mine installed a cascade of national and world records.

Records remain records, however far from all of the specialists have accepted the new technology. There is a psychological barrier as water has always been considered the enemy of the miners. The introduction of the innovation required capital outlays and a fundamental reorganization of production. "It was essential to have a specialized association. Otherwise hydraulic mining could not develop," persuaded the director of the Yubileynaya Mine, A. Ye. Gontov. The 'Gidrougol' [Hydraulic Coal] Association was established and Aleksandr Yegovorich [Gontov] headed it. He was not sparing with his promises, assuring that in 1985 coal mining by the hydraulic method in the Kuzbass would reach 15 million tons. Gigantic hydraulic mines would appear and labor productivity would leap to the unprecedented height of 500-600 tons per worker per month. And hopes were being built not on a void but rather on the orders of the USSR Ministry of Coal Industry [Minugleprom] to develop hydraulic mining.

Ten years passed. Alas, the calculations did not prove out. The capacity of 'Gidrougol' is less than 10 million tons of fuel a year, and only one-half of this amount is mined hydraulically. Labor productivity for the association dropped by one-half. No construction of hydraulic mines is being carried out....

But don't think that the new methods failed. No, where they work with water such as in the Kuzbass and Donbass [Donets Basin], the results are much higher than at the "dry" mines. But, as one miner joked: "Previously you could spot the opponents of hydraulic mining but now everyone is 'pro' while the process is slipping."

With 3½ percent in the total mining volume of the basin one could scarcely speak about any victories for the progressive method. What has happened? Why over so many years has the capacity for hydraulic mining in essence not gone beyond the limit of an experiment? Let us try to figure this out. For testing the true possibilities of the new method, two mines were built. The first on thin seams and the second on seams of medium thickness. However, soon thereafter they were brought together under a single name of Yubileynaya. Here in some way they forgot about the experimental purpose. They began to look at the united mine as an ordinary enterprise obliged to produce more coal. It was harder to produce from the thin seams and gradually the center of mining shifted to the second mine.

The more fuel that was lifted to the surface the higher, "from the achieved level," the goal was set for the next year. "Coal at any price!"--this principle, having become imperative, began to force hydraulic mining itself from the faces. In order to develop the new method and modernize new production, time was needed for testing and working out the new equipment but this inevitably cut the indicators. Instead of seeking out new ideas at Yubileynaya they made the innovative proposal of using mechanized clearing units on the long walls, that is, the equipment of the traditional "dry" methods. Some specialists, A. Ye. Gontov among them, have endeavored to justify the replacing of the hydraulic monitors by conventional mining equipment by the fact that this reduces coal losses in mining, it gives mobility to the work and as for the choice of equipment, this is dictated by the mining and geological conditions. But certainly previously the general director himself asserted that there were no seams which could not advantageously be worked by the hydraulic monitors.

This is actually the case. Judge for yourselves. A recent-design hydraulic monitor weighs just 320 kg. It costs around 5,000 rubles and has a productivity of 120 tons of coal an hour. What sense does it make at an enormous effort to push a unit weighing 400-600 tons underground, having paid a million rubles for it, if it produces almost the same amount of coal? Why borrow the equipment from the "dry" mines? The association was organized to solve the problems of hydraulic mining. And it should be concerned with these questions. First of all it should seek out the ways for reducing coal losses, improve the cutting of coal in the steeply-falling and thin seams and modernize production....

However, as long as the ministry judges the work of Gidrougol' not from its contribution to the development of new methods but by "gross output," this will remain the main guideline for the association. At present, the situation is if Gontov produces more coal they praise him but if he is shy they dress him down and not only that.... Hence, he is in a tight situation. And what happens as the result of all of this: from the very outset the new methods have been marked by the seal of the nonessential. In the drive for immediate advantage they have sacrificed the long-range goals and for the sake of quantity they have forgotten quality. The experimental plant has been taken away from the

All-Union Scientific Research Institute for Hydraulic Coal Mining (VNIIgidrougol') which was part of the association, and this again was done in the name of the plan....

In the new sections, nothing has been built for the new methods and every hope is based precisely on traditional equipment. In truth, in the future they do plan to build the large hydraulic mine Antonovskaya. But what can explain the fact that it is planned to be started up before the appearance of a processing mill. For the specialists it is a truism but it must be repeated: if there is no mill there is no hydraulic mining. Just like the instance when everyone--the Kuzbassugol' VPO [Kuznetsk Basin Coal All-Union Production Association] and the Minugleprom--were in favor of hydraulic mining but did everything to make certain it did not happen....

In terms of use efficiency at present in the nation there is nothing better or even the equal of the hydraulic coal mining method. It has already shown that it provides the highest productivity and the cheapest coal produced in the mines. Moreover there is great safety. The miner does the tunneling and is away from the face in the cutting of the coal. The developed capitalist countries have concluded licensing agreements with us for the hydraulic mining processes and this is yet another important argument. And to correctly establish the place for hydraulic mining in the specific program presently being worked out for the development of the Kuzbass up to the year 2000 would mean not only to select a correct strategy but also obtain a great increase for the national treasury.

Clearly over the next year or two hydraulic mines will not be appearing in the Kuzbass, however even now a great deal could be done. As a first step we should modernize the existing hydraulic mines. The VNIIgidrougol' has worked out and tested equipment for converting hydraulic mining from a pressure of 120 atm to 160 atm. In collaboration with other scientific research institutes, units have been developed for working at great depths and a process has been developed for purifying the recycled water.... In a word, scientific potential even now makes it possible to achieve an unprecedented labor productivity of 300-400 tons per worker per month in gently-sloping seams and 100-150 tons a month in steep seams. The conversion of the "dry" mines during reconstruction to the progressive method would make it possible to sharply lift coal output. Such points have long been known and these are primarily mines with low labor productivity but mining the most valuable grades of coking coal by the most difficult method, with heading machines. The sole Krasnogorskaya Hydraulic Mine of Prokopyevsk has a labor productivity that is almost double that of the neighbors....

None of this is a great secret. Some 10 years ago, in speaking in Kemerovo at a meeting of the activists, the USSR Minister of Coal Industry B. F. Bratchenko criticized the Prokopyevsk workers for the fact that they had not introduced the hydraulic mining methods at the mines, particularly where the traditional methods did not produce good results. A good deal of time has passed but still there is no hydraulic mining capacity....

The new method obviously should be introduced not only in the Kuzbass but also in the other coal basins. Clearly the time has come to remove the VNIIgidrougol' from Gidrougol'. But in order for the institute to gain independence, it is not enough to just grant it freedom. It is essential to expand the experimental

shops and assign to it a small mine where the designers could test out new machines and units. In our view, in the specific program provision must also be made for training personnel for the hydraulic mines. "The workers must be trained at the face. There are neither a training center nor a vocational-technical school for our mines," they complain at Yubileynaya. There is the same situation for the training of middle-level technical personnel and the small graduating class of certified specialists at the Siberian Metallurgical Institute does not resolve the problem. And the main forge for engineering personnel, the Kuzbass Polytechnical Institute, has still not become involved. It takes time to organize a vocational-technical school and hydraulic mining personnel.

...Recently we visited the Tyrganskaya Mine where one of the sections has been converted to hydraulic coal cutting. The director A. S. Kruglyak did not hold back:

"For 20 years, I worked in a 'dry' mine. Now I am completely won over by hydraulic mining. There is a gain for all items: there is no dust, no heavy weights to move around and the load on the face has almost trebled! If a processing mill were built and the mines of Prokopyevsk were converted to the new method, what prospects would open up!"

Possibly the USSR Minugleprom should listen to the opinion of the mine director and to the calculations of the specialists and scientists. It is time they recall their own orders for the development of hydraulic mining and, having revised their plans considering today's needs, give them some help.

10272

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COAL

KIRGHIZ COAL INDUSTRY DEVELOPMENT VIEWED

Frunze SOVETSKAYA KIRGIZIYA in Russian 16 Jan 85 p 2

[Article by A. Budnikov, director for the production of mines and pits of Kirgizia: "One Does Not Bask in Old Fame"]

[Text] The Sredazugol' [Central Asian Coal] Production Association includes eight enterprises of our republic. It could be pointed out that certain of them have achieved definite successes in fulfilling the quotas of the five-year plan. This applies fully to the Tash-Kumyr Mining Administration, to the Tsentral'naya Mine and to the Agulak Open Pit Mine. But we should particularly point out the Kzyl-Kiyskoye Mining Administration. For this reason. Here they take a rather sober and close look at the near and distant future and promptly resolve the questions of developing the mine and open pit fields as well as opening and preparing new levels. To put it briefly, they work with "open" eyes and the same cannot be said about the other enterprises, where they operate at times blindly and where they live with concerned thoughts for tomorrow.

But let us begin with the beginning. At present, our republic is forced to ship in around 2 million tons of coal from the nation's other basins since in recent years our fuel output has been declining. Have the fuel reserves been drying up? Is the sector running out of steam? Possibly, the root of all the evils lies not underground but elsewhere? Let us endeavor to answer these questions.

As is known, the reserves of any deposit sooner or later are worked out. But are we so poor that we can merely bask in our former glory? Certainly not. The expected coal reserves for Kirgizia are rather great. They are 17.7 billion tons of coal, including 2.3 billion tons explored and of commercial categories. The latter are located thus: 8 percent of them is within the boundaries of the existing mines and pits while 18 percent are prepared or being prepared for new construction and reconstruction of existing enterprises. Thus, 1.7 billion tons, or 74 percent of the republic's coal riches, are still not in the sphere of industrial development.

The demand for coal is constantly growing. Particularly in short supply are the large- and medium-sized grades. However, the mining enterprises are unable to meet the need for domestic fuel for the republic and our neighbors. Why? It cannot be said that there are excessively many reasons for this. But they do

exist. In the first place, the decline in fuel output has occurred, on the one hand, as a result of the developing conditions for exploiting the seams and on the other, as a consequence of the delay in geological studies on promising areas. Also making itself felt is the fact that from the end of the 1950's, geological coal prospecting was not carried out for 10-15 years and only in 1972 did money begin to be allocated for this purpose. As is known, it is an enormous distance from the end of the geological prospecting to the beginning of operations at a coal mining enterprise. And thus it happened that over all these years the coal mining capacity was in constant decline and there was no increase.

Thus, Mine No 4 in Kzyl-Kiya closed down having depleted its reserves. The basic producing seams of the Severnaya Mine in Tash-Kumyr and Mine 2/4 in Sulyukta were worked out. Thus, coal capacity declined by 890,000 tons while actual coal output over this time declined by 500,000 tons. Incidentally, we would mention that the geological conditions in the deposits being worked have become more difficult. For example, at present the depth for mining the brown coal deposits in Southern Kirgizia has reached 500-600 m (Kzyl-Kiya and Sulyukta) with an average of 150-200 m for the USSR. The dips of the seams vary from 8 to 70° while the thickness of the seams (within limits of 1-9 m) differ in terms of their structure and enclose rock.

Moreover, in two deposits the coal seams are dangerous in terms of rock jolts, two mines are bad in terms of methane and at another two the work is being carried out with the preliminary draining of the cutting fields.

All these data show that with each passing year it becomes more and more difficult for the miners to remove the coal.

What will happen in the future? In what direction will our coal industry be developing?

At present, in the place of the declining Severnaya Mine in Tash-Kumyr they have begun sinking two sloping shafts for the Tegene Mine which by 1990 should be producing the first coal. Moreover, in the republic there are two other reserve areas for new enterprises. These are the deposit of Kara-Kiche where it is possible to build a large open pit under the condition that there is a major consumer for these coals and Field No 8+11 of the Sulyukta Deposit. But for this field additional prospecting must be carried out, since detailed geological work was carried out here at the end of the 1950's and the degree of geological study of the deposit does not conform to the modern requirements of the coal industry. This site will be prepared for industrial development only in 1986, after the corresponding reconfirmation of the reserves.

Prospecting work is also being carried out at the fields of the Tsentral'naya, Dzhergalan, Severnaya and Kok-Yangak Mines, at the Kumbel Deposit and at the Uch-Kurgan and Samarkandek sections. But, regardless of the initiated measures, the situation with the exploration of the mine and pit fields remains unsatisfactory. This applies primarily to the Kok-Yangak Mine and the Tash-Kumyr Mine Administration.

For this reason it is extremely important now that the Kirghiz Geological Administration in 1985-1990 carry out prospecting in areas suitable for open pit works, in the Issyk-Kul Basin as well as in the area of the Tash-Kumyr Deposit (the southern area) and in the region of the Almalyk and Agulak open pits.

It is also essential in the 1986-1988 period to carry out preliminary exploration and before 1990 a detailed study of the Kok-Yangak--Glubokiy section and the Khodzhaklyan Deposit and carry out additional prospecting of the Tegen-shakhtnyy section with a re-estimating of the reserves.

It would be wrong to think that the Kirghiz miners themselves are not doing anything to work better and are merely waiting for centralized investment millions. In 1983, without waiting for the completion of the survey at the Kara-Tuk section in Tash-Kumyr, following a local plan mining-prospecting and then operational work was commenced to remove the overburden and mine coal. Precisely this helped to fulfill the 1983 state plan of the Tash-Kumyr Mine Administration. Since then they have already produced around 500,000 tons of coal, and the Kara-Tuk section is to become the main coal mining facility in Tash-Kumyr up to the end of this century.

They have followed the same principle in Sulyukta. At Field No 11, where prospecting work has not yet been completed, they have opened up a preparatory mining section Vostochnyy and even now they are cutting coal in a clearing face.

Specialists from the coal enterprises are working on introducing and effectively utilizing the equipment and methods of the mining, cutting and overburden-removing operations. In recent years, new, highly productive excavators, bulldozers and mechanized mining equipment have been introduced. At the Dzergalan Mine and the Kyzyl-Kiyskoye Mine Administration they have tested and introduced a new system for mining coal by subfloor drifts employing the 4PU and PK-ZR mining combines.

We would also like to say a word about one complication which has been encountered at certain deposits. For example, the Severnaya Mine of the Tash-Kumyr Mine Administration is additionally working coal reserves located along the perimeter of a complexly shaped mine field. Here the coal seam has been depleted by rock intercalations. For this reason it cannot be excluded that rock gets into the coal flow. According to the geological prospecting data, the ash content of the seams in the Kara Tuk section will also run up to 41 percent. For now other sectors with a lower ash content have not been found in Tash-Kumyr. For this reason, the workers of the thermal power plants and the power workers must now seek out technical ideas (or introduce the ones already found) which would make it possible to burn high-ash coal in the boilers.

In conclusion we would like to point out that the difficulties in which the Kirghiz coal workers have found themselves are nevertheless surmountable. There is every reason to assume that the coal industry will emerge from the slump. As we can see, there are possibilities for this.

NUCLEAR POWER

ENERGY MINISTER DISCUSSES GORKIY AST, CEMA PLANS

Riga SOVETSKAYA LATVIYA in Russian 17 Mar 85 p 3

[Article by APN Correspondant Yu. Sinyakov: "The Atom Heats the City" under the rubric "CEMA" Integration in Action"]

[Text] "Tepلودar," says the inscription at the entrance to this village which is located on the bank of the River Dnestr 25 kilometers from Odessa. The builders of a new nuclear power plant live in its multistory, varicolored buildings.

"Near Odessa there is a unique structure, an actual nuclear power testing facility," I was told in an interview by the USSR Minister of Power and Electrification Petr Stepanovich Neporozhnyy. "It is a nuclear heat-energy center--we call it an 'ATETs'--which will be a model for a whole series of new plants which are of interest to all the CEMA nations."

It has been learned that only one quarter of the resources which are used go into producing electric power. Substantially more of them are "eaten up" in boilers. Each hour, for example, a small city with a population of around 300,000 inhabitants requires up to one thousand gigacalories. This means that 400 tons of mazut have to be burned in its boilers. And this is only for household needs, and does not count heat for industry.

Furthermore, the appetites of the city's economies are constantly increasing. According to expert calculations, the demand for heat will double by 1990. It follows that the capacity of city boilers which burn mazut, coal, or natural gas will have to grow by a similar amount.

Wouldn't it be possible to use nuclear power for heating?

The idea is not new and has already been proven out in practice. For example, on the Chukotka [Peninsula] the relatively low-capacity Bilibinskaya ATETs which produces only 48 kilowatts has been in operation since 1974. For more than ten years now it has been playing two roles. First, it produces power for the local mining industry. Second, it furnishes heat to the dwellings of cold Chukotka.

"Odessa was the winner in a competition among cities to become the site for the pilot ATETs in a series of nuclear heat-energy centers," said the Director of the Odessa ATETs, Vladimir Dubenskiy.

Our conversation took place in a small wooden structure housing the administration of the ATETs which is under construction. The walls of the director's office were covered with blueprints, diagrams, and posters. There was a cut-away view of the Odessa reactor and a general plan for the production site and silhouette of the future Tepلودar, a city of living quarters for the builders and power plant personnel. But most of all there were blueprints of the heat lines through which the "nuclear heat" will be transported to Odessa. There are four lines leading to the city--four main pipes. Heated water will flow through them. Having heated the city, the water will be returned to the plant to begin its journey anew.

"We are now feeling the effect," said the director, "as the Odessa Nuclear Heat-Energy Center brings about a tangible savings of four million tons of conventional fuel per year. But this is not all. The ATETs will make it possible for us to close several hundred small boilers which smoke up, steam up, and dirty our city. Finally, one cannot forget its second significance. It provides power for a large industrial center, its port, and its health resorts."

After having become acquainted with the future, we return to the present at the Odessa ATETs construction site, which is crisscrossed by foundations. Now arising from them are the skeletons of the production buildings, including the main reactor building where two one million kilowatt capacity reactors are being erected. They are scheduled for startup during the next five-year plan.

While the Odessa ATETs facility is still just being started, another nuclear facility in the city of Gorkiy is almost completed. It is the Gorkiy Nuclear Heat Plant (AST), another new word in nuclear energy.

This initial AST has two one million kilowatt capacity nuclear units. AST's are substantially simpler, both in the design plan and in the nuclear safety area, since they are designated exclusively for heat production, and do not require complex equipment such as turbines and a cooling system. That is why they are different than the ATETs, which are set at a distance from large cities. The AST can be built practically in the vicinity of a city. Thus the Gorkiy AST is located ten kilometers from the city itself. It is scheduled for startup this year.

The CEMA nations are very interested in this facet of nuclear power. The nuclear heat plants, which these nations plan to construct in up to 2,000 cities, are part of the overall long-term program for equipping nuclear power facilities. As is known, such a program is being drawn up now in accordance with a resolution of the high level Economic Conference of CEMA Members.

In Czechoslovakia, for example, the first AST's will be built in the Ostravsko-Karvinskiy Complex by 1995 and near Bratislava by 2000.

Variations in the use of the ATETs and the AST are being examined by Bulgaria and Poland, in the latter case for three municipal regions--Gdynya, Gdansk, and Sopot.

The transformation of the "peaceful atom" into heat energy is now an urgent need for the GDR, since the republic today uses 80 million tons of brown coal for these purposes [annually]. At the same time there are conventional nuclear power plants used to supply heat needs for the GDR. In this case the Bruno Leuschner AES is unique. It not only produces industrial power, but from a distance of 22 kilometers, it completely supplies the city of Greifswald with hot water.

In conclusion, here is a short quote from the above mentioned interview with the USSR Minister of Power and Electrification P.S. Neporozhniy, who is also the Chairman of the CEMA Permanent Commission for Cooperation in the Electric Power Area. "Speaking on behalf of using nuclear sources of heat supply is their indisputable superiority in the environmental protection area. The AST and ATETs mean a city without smoke and soot."

9016

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9 July 1985

## NUCLEAR POWER

## PLASMA PHYSICIST VIEWS FUSION REACTOR FEASIBILITY

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 21 Apr 85 p 4

[Interview with Academician B. Kadomtsev, director of the Plasma Physics Department of the Nuclear Power Institute imeni I. V. Kurchatov, by L. Zagal'skiy: "Energy of the Future Century"; date and place of interview not given]

[Text] Today power engineering is one of the hottest (in the literal and figurative sense) spots of science. In the units of research physicists, plasma is boiling heated to solar temperatures. And if they succeed in harnessing for the good of mankind the analogous processes which occur within the sun and succeed in modeling them, then human civilization will open the door to an inexhaustible treasurehouse of energy sources. There will not be the problem of an energy crisis and there will be enough heat and light for all.

Today, on Soviet Science Day, we have decided to turn over the floor to a leading physicist, a winner of the USSR Lenin and State Prizes, Academician B. Kadomtsev, director of the Plasma Physics Department of the Nuclear Power Institute imeni I. V. Kurchatov.

[Question] More than 30 years have passed since a thermonuclear reaction showed the possibility of liberating enormous energy contained in the nuclei of light elements. Undoubtedly, it has been very enticing to use this energy for peaceful purposes. How far have scientists now advanced from an experiment to the real use of the scientific research results?

[Answer] It is still too early to pose the question so specifically. We are in the research stage and here the main goal is to obtain plasma with thermonuclear parameters as this would be suitable in the future for use in a reactor. This problem is presently being successfully solved. For now we are working on a T-10 unit built in 1975. It is the largest in our nation and makes it possible to obtain an electron temperature of over 40 million degrees. At present the main task is to solve the problem of increasing the temperature so as to better study the plasma properties.

[Question] Boris Borisovich [Kadomtsev], the terminology of physicists is extremely complex and, possibly, would not be comprehensible to everyone as to why it is necessary to increase the plasma temperature and also what is plasma itself?

[Answer] Plasma is a gas which has been heated to a very high temperature. That is, it is in practical terms solar matter. If we look at the sun, and it is precisely an enormous cluster of plasma, an enormous ball of matter in which the electrons and nuclei are split. They, to put it figuratively, float, so to speak, one liquid into another, one gas into another. The name the physicists have thought up is very arbitrary, because in principle plasma is simply an incandescent gas. But it has been named plasma because the behavior of the charged particles in it--the electrons and ions--differs greatly from the behavior of a neutral gas, particularly in the presence of magnetic fields. Since we are concerned precisely with a plasma in a strong magnetic field, quite naturally it in terms of its behavior is very dissimilar to a gas.

The temperature must be increased since only in a gas heated to solar temperatures is it possible to obtain a controlled thermonuclear reaction.

[Question] What are the scientific machines presently used by physicists?

[Answer] They are different ones. There are machines which in miniature can create a thermonuclear explosion. For this it is essential to heat a very small piece of matter to a very high temperature. This can be done either by beams of electrons or ions or by laser beams. Such units are presently being developed in our nation and abroad. This area is being worked on rather intensely.

The other area is related to achieving a slow thermonuclear combustion with a density of matter that is much lower so that the reaction itself occurs at a very slow rate. For this the matter--a high temperature plasma--must be placed in a strong magnetic field and prevented from coming into contact with the walls.

[Question] They say that the process of surmounting the difficulties in creating something fundamentally new is an infinite process. What presently concerns you as a scientist?

[Answer] The time has come to move from the scientific problems to the engineering ones. These are of two sorts. One type is related to developing large electrophysical units. (It is simply essential to increase the scale of those units which we have had up to now.) And respectively, with an increased scale the approaches to developing such units and the principles of controlling them will also change qualitatively. In speaking about the Tokamak-15 which is under construction, this is a unit with superconducting windings. Cryogenic equipment is required for cooling these windings to a very low temperature. Superconductivity is essential. Correspondingly, we must have superconducting technology for these purposes. A complicated control system is required. These are difficulties of the immediate future.

But the longer range difficulties are related to the particular features of the occurring thermonuclear reaction itself. This is a problem of neutron physics,

the harnessing of the energy released in the plasma and the interaction of the thermonuclear plasma with the chamber walls. Here also is a mass of problems. They must be solved step by step.

And at present, we can see how they must be solved successfully and gradually arrive at the creation of a thermonuclear reactor.

[Question] When will the first thermonuclear power plant be built, when would it produce the first electricity?

[Answer] Everything depends upon how we plan the steps, in what sequence. In principle it would be possible that, for example, by the end of the present century, between 1995 and 2000, we could develop such a system and obtain the first thermonuclear electricity. There are the possibilities for this.

[Question] Is there international collaboration on the thermonuclear question?

[Answer] Yes, in this area it has been maintained always traditionally on a good level after the well-known speech of I. V. Kurchatov in 1956 to English scientists. Since then, scientists of all nations have begun to openly exchange research results on the thermonuclear problem. But, in addition, upon the initiative of the Soviet Union under the aegis of the IAEA, an international group has been organized which is working on the international project INTOR (International Tokamak Reactor). I am just now on my way to Vienna for the next session which should report the research results over previous years. The work is of very great importance for correctly selecting the steps and directions of modern research on high-temperature plasma physics and controllable thermonuclear fusion. Even if ultimately it does not lead to the development of an international project, it will be useful for all participants for their own national programs.

[Question] What economic benefits would a thermonuclear reactor entail?

[Answer] If one speaks about economics, at present this does not look very optimistic. A thermonuclear reactor is expensive. I can anticipate your question: why then must we have a thermonuclear reactor in comparison with the already developed nuclear power?

In the distant future, we will certainly encounter ecological problems. A thermonuclear reactor, since it is cleaner than a nuclear one, with the wide scale of nuclear power, can show its advantages. In the next few years, for instance, by the end of the century or in the first decades of the following century, a thermonuclear reactor could be used as a processor of fuel for conventional nuclear power. In this sense it would become a benefit from the viewpoint of providing it with the essential fuel.

[Question] It frequently happens that in major state programs we do not immediately spot young names. Among your young colleagues are there also interesting, talented scientists? And how do you generally get along with youth?

[Answer] The collective which is presently working on thermonuclear research from the very outset was comprised of young people. Talented, energetic,

purposeful and desiring to penetrate this unknown area, to develop it and ultimately conquer it. To bring mankind a new source of energy. And while previously these were only theoretical experimenters, now obviously the spectrum has become much wider. The present scientific youth has a good mastery of computers and can create large automatic data collection systems, the data can be processed and in a short period of time the basic knowledge established from these experimental data. We have young engineers who can take up the problems of the electrophysical units, power engineering, cryogenics and superconductivity. And the fact that the thermonuclear research makes it possible for persons from different specialties to work hand in hand and thereby broaden their viewpoint and be involved in solving such a major problem, all of this, undoubtedly, contributes greatly to the growth of the youth, particularly the talented.

[Question] Boris Borisovich, let us assume that a thermonuclear reactor has already been developed and is in operation. What lies beyond this, "over the horizon"?

[Answer] Over the horizon there are even more distant prospects. The important thing is that thermonuclear power, once developed, opens up an opportunity for completely unusual technologies, for instance, the obtaining of artificial fuel. For this reason, possibly, we at present cannot guess all the possibilities which it may provide us with. We will see what is around the corner....

10272

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NUCLEAR POWER

BRIEFS

ZAPOROZHYE AES PROGRESS--(TASS)--The first power unit at the Zaporozhskaya Nuclear Power Plant produces a current of one million kilowatts for the nation's unified power grid. Automated systems direct all technological processes for producing and transforming one form of power into another at the AES. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 6, Feb 85 p 3] 9016

KURSKAYA AES PROGRESS--Installation has begun on the fourth power unit of the Kurskaya AES. The one million kW power unit will be completed this December. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 6, Feb 85 p 3] 9016

CHERNOBYLSKAYA AES STATUS--Kiev--The personnel at the Chernobylskaya AES exploit modern technology with confidence. Four one million kilowatt power units are exceeding design indicators, which in no small way was helped by the high proficiency of the engineers who operate the equipment. The personnel's high proficiency has allowed them to produce more than 80 million kilowatt-hours above their plan since the first of the year. They have been able to exploit even the freezing weather. Since the air and water temperature in these months was lower than normal, the specialists decided to decrease the volume of liquid which cools the reactor. In this way they decreased the energy demand for driving the powerful pumps and other internal needs. Such a savings during the severe winter was no small thing. [By Zh. Tkachenko] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 26 Feb 85 p 1] 9016

CHERNOBYL AES REPLACES BOILER--Kiev--Over 50,000 tons of equivalent fuel have been saved last year in the Pripyat city of power workers due to the foresight of the collective at the Chernobyl AES. As soon as the plant reached design capacity, the boiler was closed down in the city. Heat and hot water are supplied regularly to the apartments. The new engineer idea was included in the plans and for this reason the heating utilities were laid during the construction period. Such a plan was economic and farsighted. The heat which the AES can produce will be enough to provide the city's comfort, considering its development up to the year 1990. [By our own correspondent Zh. Tkachenko] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 3 Apr 85 p 2] 10272

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NON-NUCLEAR POWER

DEPUTY MINISTER DISCUSSES GRES MODERNIZATION, 1986-1990

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 30 Mar 85 p 1

[First Deputy Minister of Power and Electrification A.N. Makukhin responds to unnamed TASS correspondent: "Energy: A Program for Revitalizing the Sector"; date and place not specified]

[Text] The USSR Minenergo [Ministry of Power and Electrification] program for technical renewal and reconstruction of heat and electric power plants in the 1986-1990 period was discussed at a regular meeting of the Politburo of the CPSU Central Committee. At the request of a TASS correspondent, the USSR First Deputy Minister of Power and Electrification A.N. Makukhin spoke of several aspects of this program.

"The face of Soviet thermal power, which produces 80 percent of all the electricity in the nation," he said, "now features the world's largest heat power plants, such as the Reftinskaya, Kostromskaya, Zaporozhskaya, and other GRES. Their basic equipment are 500,000 and 800,000 kilowatt units, and large city heating plants have highly effective units of 250,000 kilowatts.

However, there still exist in the nation many GRES and TETs with obsolete, low-output equipment, whose use demands a large fuel expenditure and a large number of servicing personnel. And nevertheless, as research has shown, many of these power plants can be put to good use. This is extremely important because although there are up to ten million kilowatts of new capacity added in the nation each year, this is still not enough to satisfy the constantly growing demand for electric and heat energy.

That is why in accordance with the USSR's Energy Program work is anticipated in the next five years directed toward lengthening the service life of such equipment. The path to this is the replacement of the basic units and parts of steam turbines, boilers, steam pipes, pumps, and electrotechnical equipment which have outlived their usefulness.

Power plants whose extension of service will not be economical will be dismantled. There are also many such heat plants as, for example, the Sverdlovskaya, Intinskaya, Dneprodzerzhinskaya, Klaypedskaya GRES and others which will be refitted as heating and steam boilers. These efforts, it was noted at the Politburo meeting, must be accomplished without decreasing the output of heat to consumers.

Many units will have to be modernized to increase their reliability and economy through updating individual equipment items. There are plans to replace the monitoring and management systems on dozens of 300,000 kilowatt units, which will increase their flexibility.

Finally, an important aspect of the program is the development of a technical and economic basis and accounting procedures for subsequent reconstruction of power plants at which new equipment must be installed during the dismantling of the old. Such work is planned for the Shchekinskaya, Cherepetskaya, Kuybyshevskaya, Shterovskaya stations, as well as the first stage of Slavyanskaya and Angrenskaya GRES, and for many others.

We must mention that technical updating and reconstruction of heat plants is already taking place. For example, after starting up new equipment the first stages of the Kashirskaya and Shaturskaya GRES's were shut down and obsolete equipment was dismantled at the Tkvarchelskaya GRES, where two new turbines and four boilers were installed, and turbines at Moscow TETs No 9 and No 12 were replaced by more efficient ones.

To help accelerate the revitalization of thermal power, several ministries have been tasked to produce and deliver the required items of equipment and spare parts, and a system for financing the work and raising reliability of the TES [Thermal Electric Plants] and for modernizing operating equipment has been worked out.

"Achievement of this program," A.N. Makukhin said in conclusion, "will have great social and economic significance. It will allow us to increase the reliability of power supply to the economy, to the populations of cities and workers settlements, to use fuel more economically, and to improve the working and living conditions of power production personnel."

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NON-NUCLEAR POWER

MINISTRY CONFERENCE SETS HEAT, ENERGY SUPPLY ORGANIZATIONAL GOALS

Moscow ENERGETIK in Russian No 3, Mar 85 p 39

[Article by S. Ya. Belinskiy, candidate of technical sciences, and M.S. Ostrov M.S. Ostrovskaya, engineer; MEI-VNIPIenergoprom [Moscow Power Engineering Institute and the All-Union Scientific Research and Planning Institute of the Power Industry]: "All-Union Meeting 'Prospects for Central Heating Development and its Role in Improving the Nation's Fuel-Energy Balance'"]

[Text] Basic problems in the development of residential heating in the USSR were discussed at a scientific-technical meeting coinciding with the 60th anniversary of the first central steam heating system in the nation. Specialists from 35 cities in all of the Union republics participated in the meeting which was organized in Leningrad by the USSR Minenergo [Ministry of Power and Electrification] and by the Central Directorate of the Science and Technology Department for Power and Electrification with cooperation from GKNT [State Committee for Science and Technology], the USSR Gosstroy [State Committee for Construction], Gosplan, the USSR Academy of Sciences, and the USSR and RSFSR Ministries of Housing and Municipal Services.

The USSR First Deputy Minister of Minenergo A.M. Makukhin chaired the meeting. Welcoming remarks were delivered by Yu. A. Shibayev, the deputy chairman of the Leningrad City Executive Committee.

In his keynote address, A.N. Makukhin emphasized that our nation leads the world in its scale of central heating. Central heating allows us to save about 40 million tons of conventional fuel annually. Even more promising is the use of nuclear fuel for central heating.

Speaking at the plenary session were: Gosplan Deputy Department Chief V.I. Savin; L.A. Melentyev, academician of the USSR Academy of Sciences, B.M. Ivanov, chief of a main directorate in the RSFSR MinZhilKomKhoz [Ministry of Housing and Municipal Service]; Professor Ye. Ya. Sokolov of MEI [the Moscow Power Engineering Institute]; V.V. Nechayev, chief engineer of the Main Administration for Technical Management of the USSR Minenergo; and the director of the VNIPI-energoprom [All-Union Scientific Research Institute for the Power Industry], V.S. Varvarskiy.

The main thrust of the reports was directed toward further growth of heating supply, the flexibility of thermal and electric power plants [TETS] using fossil

fuel, the development of nuclear-based heating, and the improvement of the organizational management structure for centralized heat-supply systems.

The meeting was broken down into the following subgroups: heat supply systems and heat sources; heating networks; control, instrumentation, and automation of heat delivery systems.

The subgroup reports emphasized that further improvement in heating effectiveness is possible through introducing scientific and technical developments which have been proven in practice.

In thematic plans of institutes subordinate to USSR Minenergo and in other institutes and organizations one sees reflected the most topical directions and tasks of modern heating systems. There is work in progress:

--on improving the economy of the TETs (at the VTI [All-Union Institute of Heat Engineering imeni F.E. Dzerzhinskiy], the MEI, the Kirov Polytechnical Institute, and the Soyuztekhnenergo [probably, the All-Union Association for Energy Technology]);

--on environmental protection (at the VTI, NII Ogaz [State Scientific Research Institute for Gas Purification in Industry and Sanitation], the Kalinin Polytechnical Institute, Azinneftekhim [the Azerbaijan Scientific Research Institute for Petroleum Chemistry], the AzISI [Azerbaijan Construction Engineering Institute] and others);

--on corrosion protection (at the TsNII TMash [Central Scientific Research Institute for Machine Building Technology], the VTI, the VNIPInergoprom [the All-Union Scientific Research and Planning Institute for the Power Industry], and the Kiev Polytechnical Institute);

--on improving the technological level and reliability of heat delivery networks and modernizing the heat piping design and industrializing their manufacture (at VNIPInergoprom, the VTI, Soyuztekhnenergo, Orgenergostroy [the All-Union Institute for Design and Organization of Power Plant Construction], Atomteploeektoproyekt [probably--All-Union Nuclear Facility Construction Administration], Soyuzenergozashchita [probably--All-Union Association for Power Plant Safety], and AzNII E [Azerbaijan Scientific Research Institute for Power Engineering]).

--on full automation of all elements of central heating delivery systems (at VNIPInergoprojekt [the All-Union Scientific Research and Planning Institute for Power Plant Design], the VTI, the VNIIGS [All-Union Scientific Research Institute of Hydrology and Sanitation] of the USSR Minmontazhspestroy [Ministry of Installation and Special Construction], the Karaganda Polytechnical Institute, the Siberian Power Institute, the Academy of Communal Services, LenNIIproekt [the Leningrad Scientific Research Institute for Planning] and others.).

The conferees adopted the following recommendations:

USSR Minenergo and Minenergoash [USSR Ministry of Power Machine Building] are to accelerate heat and electric plant design and construction, to build heat network equipment which is designed to use the energy from nuclear sources; to modernize the currently produced turbines to increase the specific combined power developed; to accelerate development of complex programs to utilize obsolete power plant equipment;

USSR Minenergo is to develop a program to increase the utilization level of existing TETs equipment during the 12th Five-Year Plan, along with a more precise specification of the list of new equipment; to plan for annual additions of thermal loads to the TETs capacities;

USSR Gosstroy and Minenergo, in order to increase exploitation and reliability levels of the heat network, are to increase quality control at their facilities and are to adopt new heat insulation materials (polyurethane heat insulation with waterproof coatings, polymer concrete, reinforced foam concrete with waterproof coatings, and others), corrosion resistant coverings, non-metallic pipes for hot water supply systems;

USSR Gossnab [Committee for Material and Technical Supply], Minkhimmash [USSR Ministry of Chemical Machine Building], Minneftekhim [the USSR Ministry of the Petrochemical Industry] are to assure delivery of the goods and materials needed for the progressive designs;

USSR Minenergo is to increase heat-supply effectiveness through maximum use of the heat producing capabilities of KES [Condensation Power Plants] and AES:

--by modernizing KES equipment which has reached its output limits, to provide, when necessary, a substantial increase in heat output;

--to recommend installation on AES type K-1100/1500-4 turbines with 450 Gcal/hour output, K-1070/1500-3 turbines with 800-1,200 Gcal/hour output. To assign the technical tasking for development of K-1000/3000-60-2 turbines with heat output of 600 Gcal/hour;

--to accelerate the completion of the Kursk city heating project using the Kurskaya AES.

The meeting tasked all members of NTO [Scientific-Technical Departments] of the power and electrotechnical industries--workers, engineers, scientists--to participate actively in the development of heating, increasing its reliability and economy, and increasing the quality of centralized heat supply in the nation.

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9016

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NON-NUCLEAR POWER

CEMA OFFICIAL DISCUSSES ECONOMICS OF POWER LINE TO WEST

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 11,  
Nov 84 pp 68-69

[Article by Pal Kovacs, member CEMA Secretariat: "European Power Systems: East-West"]

[Excerpt] The elaborations of the CEMA Permanent Commission on Cooperation in the Field of Electric Power (referred to hereon as the Commission) are serious investigations of the question of the possibility of unifying power systems and transmitting electric power among countries of Eastern and West Europe as also the report of the CEMA Secretariat "Certain Considerations on the Plan of Organizing Work in Problems Connected with the Conduct of Research in the Development of International Unification of Power Systems" and the Soviet Union's report "Unification of the Power Systems of Eastern and West Europe" prepared for work by the group of experts on problems of planning and operation of large power systems of the U.N. European Energy Commission on Electric Power.

The advantages of unifying the power systems of Eastern and West Europe stems from the following factors:

- varying provision of individual countries with their own power resources (coal, petroleum, gas, hydropower);
- seasonal and climactic dependence of production of electric power, especially at hydroelectric power stations;
- availability of free areas for the construction of new large power facilities;
- need of covering electric-power peaks during morning and evening maximum-load hours;
- a different approach in the countries of West Europe to problems of use of atomic power;
- extraneous circumstances connected with sharp natural changes resulting in breakdowns of power supply.

In studies of the Commission on possible unification of the power systems of West and Eastern Europe carried out in 1979-1982, technical solutions are examined of certain variants of electrical connections between the power systems of Eastern and Western Europe through the creation of:

--short system connections of alternating current with a voltage of 400 kilovolts;

--intersystem transmission of alternating current with a voltage of 750 kilovolts;

--intersystems connections of direct current with a voltage of 1,500 kilovolts (plus or minus 750 kilovolts);

--rectification-inverter substations (direct-current fuses);

--combined electric-power transmissions of direct and alternating current.

The Commission's studies showed that the present-day level of technological development makes it possible to organize a 2,400-kilometer electric-power intersystem transmission for the East and West both of alternating and direct current with a voltage of 6 gigawatts.

A significant defect in connection with alternating-current is the need of erecting at the first stage of powerful electrical transmission, throughput capacity which must provide reliable parallel operation of large power facilities, although such a throughput capacity is as yet not required according to the conditions of possible exchange of electric power.

The same defect, although to some extent a smaller one, is possessed by direct-current main-line electric-power transmission; the capacity of the equipment at substations can be increased where necessary but the basic capital investment on the basis of the maximal calculated transmitting capacity must be realized in the initial stage.

Significantly smaller organizational difficulties are produced by the erection of direct-current insertions between the electrical networks of the unifications of East and West Europe. Realization of this proposal possesses technical advantages. There should be included among them the absence of the reciprocal influences of the connected electric-power associations, as a result of which strict observance is secured of the coordinated causes and principles of transmission and exchange of electric power. Direct-current insertions make it possible to carry out a stage-by-stage increase of the throughput capacity of connection between the power systems of the countries of Eastern and West Europe, which will reduce the amortization period of capital investment.

At the present time, the construction of the direct-current insertion has already been completed and it has gone into operation between the power systems of the USSR and Finland. Its throughput capacity reaches 1,065 megawatts. The same also applies to 330- and 400-kilovolt adjoining

alternating-current electrical transmission lines. Since 1983, an intersystem 400-kilovolt alternating-current electrical transmission line between Czechoslovakia and Austria and a direct-current insertion with a throughput capacity of up to 550 megawatts in Dirnor (Austria) have been in operation. A 400-kilovolt electrical transmission line connecting Bulgaria with Turkey, which now operates on 220 kilovolts, has been built. A decision was made on the erection of a 400-kilovolt electrical transmission line and a direct-current insertion between Bulgaria and Greece, and talks are going on on the creation of a direct-current insertion between Hungary and Austria.

The construction of a direct-current insertion of about 500 megawatts requires as a rule the erection of special electrical transmission lines connecting it with adjoining power-system networks. A preliminary estimate shows that with a capacity of up to 1,000 megawatts for a direct-current insertion, its connection could be made with 400-kilovolt lines. A further increase of throughput capacity will require the erection of lines with a higher class of voltage. In the united power systems of the CEMA member-countries, the use of 750-kilovolt lines is possible for this purpose. The voltage of lines intended for connection with direct-current insertions in power unification of the countries of Western Europe has so far not been determined.

The basic directions of cooperation of the united power systems of CEMA member-countries with the power system of West-European countries could be:

--export of electric power;

--exchange of electric power for the purpose of realizing the effect from combining electric-load schedules of the power systems located in different times zones;

--seasonal exchange of electric power or exchange of the daily schedule in different zones;

--emergency mutual assistance.

At the present time, talks on the long-term export of electric power have been concluded between the USSR and Finland and Poland and Austria. Appropriate high-voltage electrical transmission lines and direct-current insertions have been erected for this purpose.

In the case of a significant rise in demand for electric power in West Europe toward 1990 or later, the long-term export of electric power from Eastern to West Europe could be expanded on the basis of mutually acceptable conditions.

In the structure of electric-power production in some of the power systems of the countries of West Europe, first of all Austria, Switzerland and Norway, hydroelectric power stations are of predominating importance. In connection with limited possibilities of regulating the discharge of water, these countries are interested in a seasonal exchange of electric power. Such an exchange is being realized at the present time by power systems of West-

European countries and among individual countries of Eastern and West Europe, for example between Austria, Hungary and Czechoslovakia and beginning with 1985 it is planned between the USSR and Austria.

Exchange of electric power, balanced daily, can be done on the basis of realization of the intersystem effect from the combination of load schedules, but in this it is necessary to take into consideration that this depends to a significant degree on the season.

Intersystem connections between countries of Eastern and West Europe can contribute to providing users of electric power in case of unforeseen circumstances in the operation of power systems and in planned maintenance work (for example, of large power units at atomic electric power stations). In such a case, exchange of electric power aimed at reciprocal reservation can partially replace the construction of reserve capacities of power systems in Eastern and West Europe. Technical-economic analysis and experience confirm that in cost terms outlays on the construction of additional intersystem connections are less in comparison with the capital investment required for putting into operation equivalent generating capacities.

The economic effectiveness of exchange of electric power among different power associations will be determined aside from the effect of curtailing capacities on the basis of combining schedules of load and reserve of capacities by the possibility of reducing the expenditure of deficit types of fuel; (petroleum, gas) as a result of optimal utilization of atomic electric power stations and thermal condensation electric power stations operating on cheap forms of fuel.

An investigation of further possibilities of mutual beneficial exchange of electric power, particularly among the power associations of Eastern and West Europe is being carried out by the CEMA Permanent Commission on Cooperation in the Field of Electric Power, for example, in its development of the Concept of Prospective Development of Electric Power Within the Framework of the Unified Electric-Power Systems of CEMA Member-Countries to the Year 2000.

The collaboration of CEMA member-countries in implementing the power strategy within the framework of the U.N. European Economic Commission is in accord with the positions of the Concluding Act of the Conference on Security and Cooperation in Europe and the final document of the Madrid meeting.

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9 July 1985

## NON-NUCLEAR POWER

## UKRAINIAN GRES MODERNIZATIONS, STOPPAGES DESCRIBED

Moscow EKONOMICHESKAYA GAZETA in Russian No 8, Feb 85 p 9

[Article by V. Zhmurko, general director of Donbassenergo Association: "All Reserves to Be Put to Work"]

[Text] The following is written in the socialist commitments of our collective for 1985: to work for two days on economized fuel. The fact is that we have to save standard fuel in the amount of 125,000 tons. And this requires carrying out of organizational work and introducing new technical and technological measures.

At Zuyevskaya GRES-2, a unique cooling tower has gone into operation for cooling water and boilers were rebuilt for burning seasonal surpluses of natural gas.

Equipment is also being modernized at other stations. It is all the more important that we use a large amount of low-grade coal and it is therefore necessary to increase the economic of operation of units. Modernization has already been carried out of four boiler units of 300-megawatt power units at Uglegorskaya GRES as well as 10 units at Starobeshevskaya and Voroshilovgradskaya GRES. This year, modernization will be completed of the equipment at Uglegorskaya GRES and reconstruction will also be continued at other electric power stations.

All this work is being done with the active participation of repair personnel. This is why it is so important to properly organize the work of fitter and electric installers. Last year we were able to handle the planned volume of repair work through the introduction of the brigade contract. Now 23 percent of the repair workers are working on a single order, and we plan to include 50 percent of the personnel in this form of labor organization.

The socialist commitments also include the following point: to reduce forced stoppages of the units. They are being reduced 10 percent on the average for the year, but they remain rather high as before. A 10-percent reduction of forced stoppages of power units will provide a saving of about 2,100 tons of standard fuel. But not everything depends on power unification. We have serious complaints against suppliers of welding electrodes, particularly with

respect to Kiev Experimental Plant of the Electrowelding Institute. The fact is that 14 percent of the damage occurs because of poor quality welding.

Another very important requirement is to eliminate overexpenditures of fuel for internal needs. In 1984, a total of 134 measures were carried out aimed at the solution of this problem, which made it possible to reduced overexpenditure by 18 percent. Yet 300,000 tons of standard fuel were nevertheless lost. For this reason introduction of scientific-technical developments is being continued, including for protection of gas wastes because of low-temperature sulfur corrosion.

Fuel economy is helped by the competition for personal-efficiency accounts. At the association, more than a thousand collective personal accounts and more than 5,000 individual accounts have been opened.

Many reserves exist for operating on economized fuel. All that is necessary is to be able to skillfully use them.

7697

CSO: 1822/218

9 July 1985

## NON-NUCLEAR POWER

## BRIEFS

THERMAL POWER STATION PROGRAM--The CPSU Central Bureau examined at a regular meeting the program of reequipment and modernization of thermal electric power stations of the USSR Ministry of Power and Electrification for 1986-1990. The realization of this program will be of important social and economic significance. It will make it possible to increase the reliability of power supply to the national economy and the population of cities and worker settlements, to utilize fuel more economically and to improve the working and living conditions of power-engineering specialists. A wide range of measures has been designated aimed at extending the operational life of a number of electric power stations, replacement of obsolete power units, modernization of a portion of the power equipment and transformation of certain electric power stations into heating and steam boiler rooms without reducing delivery of heat to users. Targets were set for the manufacture and delivery of essential components of equipment and spare parts. [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 29 Mar 85 p 1] 7697

MAGNETOHYDRODYNAMIC ENERGY TRANSFORMATION RESEARCH--Moscow--On the eve of the '50-'60s, a new direction--the magnetohydrodynamic (MGD) method of transforming energy--emerged and began to develop rapidly. Its use at electric power stations makes it possible to significantly increase their efficiency. In recent years, MGD technology in the world has assumed the level of industrial elaboration. Very large power-machine construction and electrical engineering institutes and design bureaus are taking part in the planning and fabrication of units of MGD electric power stations. In our country, much scientific-research work in the field of MGD transformation of energy is being conducted at the Institute of High Temperatures of the USSR Academy of Sciences (IVTAN). Here a fundamental study has been carried out of a number of physical and magnetohydrodynamic phenomena, making it possible to solve new scientific and technical problems of creating power MGD installations. According to the basic directions of its work, the Institute of High Temperatures is carrying out scientific and technical collaboration with CEMA member-countries. In accordance with the agreement on scientific and technical cooperation of member-countries of the Council of Economic Mutual Aid, the Institute of High Temperatures has been assigned the function of a coordinating center of scientific research and development conducted in CEMA countries on problems of magnetohydrodynamic transformation of energy. [Text] [Moscow GOLOS RODINY in Russian No 8, Feb 85 p 3] 7697

9 July 1985

BUREYSKAYA GES UNDER CONSTRUCTION--On 21 February, the first concrete was laid for the dam of the largest, the Bureyskaya, hydroelectric power station in the Far East. The Bureyskaya has many innovations. "We are using for the first time in domestic practice continuous layer laying of concrete. This makes it possible to use a fast method of building a dam," A.M. Shokhin says. The Bureyskaya GES will be the basis for a unified power system for the Far East. Its annual output will be 7 billion kilowatt-hours of electric power. The station will provide a stable power supply for Khabarovsk, Komsomolsk-na-Amure and other large industrial centers of the Far East. "Still more significant prospects are opening up in connection with the forthcoming construction in these localities of the most powerful cascade of hydroelectric power stations in the Far East," said Yu.Ye. Apolonov, the chief of the Leningrad section of Hydroproyekt. "Beside the Bureyskaya, another five hydroelectric power stations will be included in the Urgalskiy hydropower complex, the power of which will make it possible to successfully solve the tasks of economic development of the BAM area." [Excerpts] [Moscow IZVESTIYA in Russian 23 Feb 85 p 2] 7697

HOLLOW 60-MILLIMETER WIRE DEVELOPED--Ekibastuz--A great deal has been done at the Ekibastuz substation to incorporate the very latest achievements of science and technology. The nation's scientific centers are developing and its plants are producing original motors and apparatus for special order of the ETEK [Ekibastuz Fuel and Energy Complex]. Thus, the Moscow Electrotechnical Plant has delivered to Ekibastuz a hollow aluminum wire 60 millimeter in diameter for the substation. Until now energy workers could only dream of such a thing. It significantly lightens support structures and its use prevents large current losses. Such novelty is in everything. [By special correspondent V. Stupak] [Excerpt] [Alma Ata KAZAKHSTANSKAYA PRAVDA in Russian 7 Mar 85 p 1] 9016

NEW SURGUT POWER UNIT--The first main 800 thousand-kilowatt energy unit at the Surgutskaya GRES-2 has delivered power to the country's Unified Power Grid two years ahead of schedule. The power plant will utilize the petroleum and gas deposits of the Tyumen Oblast. The commissioning of the first power unit significantly improves supply of cheap energy to the petrochemical complexes of Western Siberia. This year the construction personnel are to start building yet another unit of the same capacity. [by M. Agranovich] [Text] [Moscow PRAVDA in Russian 11 Mar 85 p 2] 9016

SREDNEURALSKAYA GRES FUEL SAVINGS--Sredneuralsk Sverdlovsk Oblast--At the end of last year the power plant personnel of the Sredneuralskaya GRES promised to expend no more than 314.7 grams of fuel per kilowatt hour produced. Such an expenditure ratio had not been achieved in any similar power plant unit in the nation. The task was accepted. However the call of the party to work for two days per year on resources which had been saved made them seek new reserves. They started quickly to introduce scientific and technical developments and rationalization proposals. All this allowed them to achieve notable results. The power plant personnel set a new record for the ratio of fuel expenditure to power produced by the 300-megawatt units. They used only 313 grams of fuel per kilowatt hour. [by correspondent A. Mal'tsev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 28 Mar 85 p 1] 9016

GENERAL

USSR, CEMA ELECTRIC POWER PRODUCTION SURVEYED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 85 pp 101-108

[Article by Yu. Savenko, department chief, CEMA Secretariat: "Electric Power Engineering in CEMA Countries and Multilateral Collaboration"]

[Text] During the period since the 13th (Special) Session of CEMA (1969), the course taken for the development of socialist economic integration between CEMA countries has, by making use of the advantages of planned economies and the possibilities of mutually advantageous collaboration, strengthened their economic and scientific-technical potential and improved the material and cultural living standards of the populations. The conditions have been created for these countries ' further economic development and collaboration, for the accelerated conversion of their economies to intensive development paths and for the qualitative technical updating of production on the basis of scientific-technical achievements. Successful solutions to these tasks make growing demands to economically and effectively use all types of resources, especially fuel and energy.

The economic summit conference of CEMA countries (Moscow, 1984) noted that "Through the mobilization of their own resources and the intensification of mutual collaboration it is possible<sup>1</sup> for all CEMA countries to solve their raw material and fuel-energy problems."

Meeting these countries ' requirements for fuel and energy involves the realization of a complex of measures directed towards the economic and rational use of energy carriers, changes in their production and consumption structure and reductions in the energy intensiveness of national economies, above all through the development and introduction of progressive, energy conserving technological processes, machinery, equipment and materials. There should be specific measures in these directions in the collaboration program, which covers questions in fuel and energy resources up to the year 2000. It will be discussed at the forthcoming 1985 CEMA session.

The conference noted that the countries are taking measures to develop collaboration in the production an mutual deliveries of fuel, energy and raw materials. At the 39th CEMA Session (October 1984), N. A. Tikhonov, chairman of the USSR Council of Ministers, noted the Soviet Union's readiness to continue deliveries of petroleum and many types of raw materials to CEMA countries and to increase exports of natural gas and electrical energy.

The conference decided to further deepen CEMA country economic policy coordination, including energy supplies. It formulated the most important tasks in this area. Above all, this means the necessity of changing energy generation structure and expanding collaboration, especially in nuclear power engineering, developing a program for the construction of atomic electric stations (AES) and atomic heat supply stations (AST) up to the year 2000 and to completely use all types of energy carriers, including new, non-traditional sources of energy. Conference materials noted the advisability of further developing CEMA countries' unified energy systems. These tasks will be solved within the framework of national economic plan coordination and long term contracts.

These directions in collaboration in electric power engineering are a component part of the appropriate section of the USSR Energy Program. These, and other principles of the Economic Summit and the decisions of the 39th Session of CEMA will find reflection in the Basic Directions for the Economic and Social Development for the USSR for 1986-1990 and for the period up to the year 2000.

The character and intensity of changes in the energy economies of CEMA depend on specific conditions and features in the development of their national economies (in particular, their structure, the pace and direction of development, the levels of energy and electricity available to labor and households, the potentials and economic aspects of using various types of energy carriers). The presence and reliability of the appropriate international economic ties also have a substantial influence.

A national economy's level of energy saturation and the degree of its electrification determine, to a great extent, the efficiency of social production.<sup>2</sup> Because of this, CEMA countries are giving more attention to the development of their electric power engineering base (See Table 1). In 1983 countries in the commonwealth generated 1,881 billion kWh of electrical energy, 21.8 percent of world generation (in 1960 the figure was 17.3 percent and in 1950 it was 13.6 percent).

In the majority of these countries the electric power development plans covering 1981-1985 are characterized by the intensive development of national natural energy resources (including hydro and low heating value solid fuels) and a striving to maximize its efficiency, reduce fuel and energy losses during production, conversion, transmission and use of electrical energy and heat. The changes proposed in the balances of capacity and electrical energy in a number of countries (for example, Bulgaria, Hungary, the GDR, the USSR and Czechoslovakia) are evidence of a substantial increase in the share of nuclear energy facilities. The intensive development of national electrical energy systems and intersystem electrical ties is continuing.

Country	Electrical Energy Generation, Bil. kWh			AES Installed Capacity Million kW			Per Capita use of Electrical Energy, kWh		
	1960 r.	1970 r.	1983 r.	1960 r.	1970 r.	1983 r.	1960 r.	1970 r.	1983 r.
Bulgaria	4.7	19.5	42.6	0.92	4.12	9.63	595	2 290	5 100
Hungary	7.6	14.5	25.7	1.48	2.73	6.05	815	1 720	3 230
Vietnam	...	...	4.2	...	...	1.55	...	...	73*
GDR	40.3	67.7	104.9	7.84	12.57	21.79	2 312	3 980	6 380
Cuba	...	4.9	11.6	...	0.89	3.00	...	574	1 160
Mongolia	0.1	0.5	1.8	0.06	0.22	0.52	112	440	945*
Poland	29.3	64.5	125.8	6.32	13.89	27.88	995	1 980	3 360
Romania	7.7	35.1	70.3	1.78	7.35	17.99	415	1 610	3 210
USSR	292.0	741.0	1 418.0	66.72	166.15	293.56	1 360	3 030	5 100
Czechoslovakia	24.5	45.2	76.3	5.71	10.81	18.86	1 775	3 380	5 080

\*Electrical energy output per capita

Table 1

The fraternal countries' fuel and energy balances during the current five-year plan reflect a striving towards a more active use of converted forms of energy, especially electrical energy. If a number of other factors are present, this permits not only the more complete use of the available potential of nuclear power, low heating value solid fuels, hydropower and a number of renewable natural energy resources (in particular, geothermal and solar energy) but also, the more intensive replacement of petroleum, and later, gas, in technological processes.

The European CEMA countries have higher growth rates of electricity use compared to the growth of energy use as a whole. The growth in electrical energy generation and use promotes the rapid development of their national economies and an increase in the energy available to labor. Thus, during 1971-1983 its growth in the industrial sectors was: in Bulgaria - 158 percent, Hungary -- 178 percent, the GDR - 127 percent, Poland - 151 percent, Romania - 121 percent, the USSR - 145 percent and Czechoslovakia - 130 percent.

To a considerable extent the successful development of electrification in the CEMA countries is taking place through their joint efforts. Collaboration practice shows that electric power engineering is the sector of the national economy most suitable to the intensification of international economic ties. This is, above all, due to technological and economic characteristics which, with an uneven regional distribution of natural energy resources, make possible the more complete use of low heating value fuel, nuclear and hydro power and the parallel operation of interconnected power systems (OES). These objective prerequisites determined the top priority attention to questions of multilateral collaboration in electric power engineering in the Council for Mutual Economic Assistance.

The CEMA Standing Commission on Collaboration in Electrical Power Engineering prepared number of broad studies on fundamental problems in the sector's long term development. These include the General Scheme for the long term development of OES and questions of collaboration in this area, including the corresponding ties with the SFRY. Based on the countries' intended development paths for these sectors up until 1990, this research permitted the timely coordination of their efforts to cover their needs for electrical energy and to assure high levels of energy supply reliability. The coordination of basic directions in the economic and technical policies for the development of electric power engineering up until 1990 was of great importance here.

The research conducted during the development of the General Scheme noted that in order to more completely use the advantages of OES parallel operation, it is essential to build intersystem electric transmission lines of sufficient capacity. Given the assumed conditions for OES development up until 1990 it was deemed advisable to build 750 kV lines. The General Scheme calls for the construction of a number of intersystem lines of such voltage. The first of them, (the Vinnitsa - Western Ukrainian (USSR) -- Albertirshoh (Hungary)) was put into operation in 1979.

The General Scheme called for a number of integrating measures, these are now being implemented: the joint construction, by the countries involved, of the Southern Ukrainian and Khmel'nitskaya AES's and the construction of 750 kV power lines between the USSR and Poland and between the USSR and Romania and Hungary.

The general agreement on collaboration in the long term development of interconnected power systems of CEMA countries up until 1990 was based on the General Scheme. In November 1977 it was signed by the authorized representatives of Bulgaria, Hungary, the GDR, the Mongolian People's Republic, Poland, the USSR and Czechoslovakia. This agreement, a very large international project, determines the main directions for the coordinated strategy of collaboration between the European socialist countries and Mongolia in the joint solution of the most important problems in the development of electrical power engineering, including nuclear.

The General Scheme and the General Agreement served as the basis for the development of the power engineering section of the Long Term Targeted Program for Collaboration (DTsPS) to meet the economically substantiated requirements of CEMA countries for the main types of energy, fuel and raw materials up until 1990 which was approved by the 32nd Session of CEMA (1978).

The CEMA countries Economic Summit noted the urgency of the Comprehensive Program for the Further Deepening and Development of Socialist Economic Integration and of the DTsPS, the contents of which are being implemented. Collaboration agreements and programs were prepared and signed on the basic circle of measures in the DTsPS. These include measures for the rational and efficient use of fuel and electric power.

The 39th Session of CEMA, which met in Havana, approved the Long Term Comprehensive Measures for Collaboration in Energy, Fuel and Raw Materials up until 1990 and beyond. It provides for the joint construction of a number of large projects and specific developments directed towards realizing the decisions of the conference and supplementing the DTsPS with regard to the set of measures and the period involved. The Long Term Comprehensive Measures included large projects, in particular, those assuring the further development of OES in CEMA countries upon the signing of the General Agreement, the preparation of an AES and AST construction program up until 2000, the use of coal deposits in Poland, the construction of the Yamburg - USSR Western Border gas pipeline and facilities at the Yamburg gas field in order to increase gas deliveries to the European socialist countries .

Based on these decisions, and including experience in collaboration, in 1984 the Standing Commission completed the "Concepts for the Long Term Development of Electric Power Engineering Within the Frameworks of CEMA Country Integrated Power Systems up to the Year 2000".

The leading directions in CEMA countries collaboration in electric power engineering include assistance in the development of their generating potential and progressive changes in the structure of capacity and electric power balances.

At present the predominant share of electrical energy in the European socialist countries is generated at thermal, principally steam turbine electric stations (TES). In 1983 their share in total generation was: in Bulgaria -- 63 percent, Hungary -- 89.6 percent, the GDR -- 80.8 percent, Poland -- 97.4 percent, Romania -- 85.8 percent, the USSR -- 79.6 percent and Czechoslovakia -- 87 percent.

Because of the striving to more economically use natural energy resources there is a tendency to reduce the combustion of liquid fuel and natural gas at TES and to increase the share of local, especially low heating value solid fuels. The efficient use of low heating value fuels, for example, brown coals and lignite, at CEMA country TES's is assisted by the extensive exchange of scientific-technical and production experience and joint research. Bilateral and multilateral collaboration are the basis for a number of large TES designed for low heating value solid fuels which have been built or are in the construction stage. These include: the Maritsa Vostok (Bulgaria), the Hagenwerder-III (GDR), Turoszov, Konin-Turek, Turov, Pontnuv and Belkhatuv (Poland); the Krayova, Rovinar and Turchen (Romania) and the Melnik-III (Czechoslovakia).

The Standing Commission has also carried out a number of studies on operational improvements at TES, including improvements in functional and water chemical regimes, the modernization of basic equipment and heat and process systems. According to present estimates, the implementation of these measures will improve TES reliability and assure a 2-3 percent fuel savings.

The socialist countries are conducting joint research on the development of steam-gas installations rated at 250 MW and more, with high pressure steam generators and intracycle gasification of solid fuel under pressure. Their introduction might yield fuel savings of up to 7 percent. Great attention is given to the development of centralized heat supply and cogeneration to improve the efficiency of fuel use in power engineering.

One of the most effective directions for the improvement of economic indicators in power engineering is the updating and reconstruction of obsolescent TES (including the use of 160-300 MW condensation units to cover heat loads). Their total capacity is very significant. For example, in the USSR just during the 80-90's it is intended to dismantle and modernize obsolescent and low efficiency equipment at electric stations with capacity totaling 55-50 million kW.

The realization of joint developments, together with other factors has helped the step by step improvement in the basic operating indicators of thermal power engineering in CEMA countries. Thus, solid fuel consumption per kW at general use electric stations during 1971-1982 was reduced as follows: in Bulgaria -- by 4.3 percent, Hungary -- 13 percent, the GDR -- 16 percent, Poland -- 15.5 percent, the USSR -- 11 percent, and in Czechoslovakia, 10.3 percent.

Qualitative changes in thermal power engineering in CEMA countries in the next 10-15 years will be linked to the introduction of more progressive, economical and reliable equipment with higher unit capacity, reductions in time to put it on line, further industrialization of construction-installation work, refining the conditions for using low heating value coal, the development of cogeneration, including the introduction of new equipment intended mainly for burning solid fuel.

The changes in CEMA countries capacity and electricity generating balance proposed during this period involve the development of nuclear power engineering. In a number of countries AES's will provide for a large share in the growth in generation, while in the USSR they will meet demand in regions to the west of the Ukraine and a long way from promising fuel deposits.

AES use in CEMA countries now makes it possible to save about 60 million tons of standard fuel annually. Total AES installed capacity in Bulgaria, Hungary, the GDR, the USSR and Czechoslovakia was 25.8 million kW at the end of 1983 and their output reached 142 billion kWh, 8.5 percent of total generation in these countries. In some countries the share of AES's in generation is even higher, for example, in Bulgaria it is almost 29 percent.

Nuclear power plants are built in CEMA countries with help from the Soviet Union. All of the commercial AES put into operation use 440 MW water cooled, water moderated reactors. The operation of these stations has shown the high reliability of their equipment. The installed capacity use factor is 75-80 percent, exceeding similar indicators for many AES's in the developed capitalist countries. This is evidence of the highly skilled personnel and high quality equipment.

There is extensive nuclear power plant construction in the CEMA countries in the current five year plan. Work is continuing on the fifth unit at the 1000 MW Kozloduy AES in Bulgaria. In September 1984, the startup of the second 440 MW reactor completed the construction of the first stage of the Paksz AES in Hungary and new VVER [water-moderated, water cooled reactor] 440 MW blocks are supplementing nuclear power in Czechoslovakia. AES's are planned or under way in Cuba, Poland and Romania.

The CEMA countries nuclear development energy program for the period up to 1990 required a fundamental solution to questions of organizing the production of the entire assortment of power engineering equipment. For this purpose, in the middle of the 1970's the socialist countries began extensive preliminary preparations for the production of equipment for the planned AES's. This was completed by the 1979 signing, by the heads of state of Bulgaria, Hungary, the GDR, Poland, Romania, the USSR, Czechoslovakia and the SFRY, of the Agreement on Multilateral International Specialization and Cooperation in the Production and Mutual Delivery of Equipment for Atomic Electric Stations for the Period 1981-1990. Its implementation will increase AES capacity up to about 100 million kW.

In order to carry out this agreement, a machine building base capable of producing all the specialized equipment for AES with VVER-440 reactors was developed. The production of equipment for installations with VVER-1000 reactors is being organized on the basis of international specialization and cooperation during the current five-year plan.

Work on the use of nuclear fuel for centralized heat supply is being done within the framework of CEMA. Thus, in the USSR work began on the first nuclear heat and electricity central plants with energy units using VVER-1000 reactors, two 500 MW turbines and AST with 440 Gcal/hr reactors. AST with reactors rated at about 260 Gcal/hr are being planned and research work is under way on atomic stations for industrial heat supply.

The rapid development of nuclear power engineering in the CEMA countries is linked to research on problems of increasing the unit capacity of equipment for AES using thermal reactors, the transition to the extensive industrial use of fast reactors, the use of nuclear installations for municipal-household and industrial heat supply and the determination of AES maneuverability requirements. In accordance with measures for the sectorial section of the DTsPS for energy, fuels and raw materials the collaboration agreement is now being implemented through scientific research and experimental design work on problems in the mastery of energy units with using VVER-1000 reactors, in further improvements on reactors of this type and in the development of large capacity fast reactors (liquid sodium and high temperature gas cooled reactors). Within the framework of the research program on thermonuclear fusion up until 1990, the USSR, Bulgaria, Hungary, the GDR, Romania and Czechoslovakia are collaborating in this area.

The expanding introduction of TES with large capacity units and the intensive development of AES are complicating the problem of covering the variable parts of the electric load schedule. The creation of maneuverable capacity in

quantities sufficient to assure electricity supply reliability and normal operation of AES, especially during reduced loads is acquiring special significance for CEMA countries energy systems.

The construction and rational use of operationally flexible generating capacity structures and the attainment of maximum effects during parallel operation are first priority tasks in the development of electric power engineering in the fraternal countries. Their solution is assisted by collaboration within the framework of the Standing Commission. It is planned to use GES, GAES, special semi-peak condensing units burning solid fuels and gas turbine units to cover the variable part of load schedules in addition to the allowed use of baseload energy units.

According to present estimates, the hydro power potential of the USSR is 1,095 billion kWh, that of Bulgaria -- 13, Hungary -- 3.6, the GDR -- 0.7, Poland -- 12.1, Romania -- 40 and Czechoslovakia -- 9 billion kWh. At the end of 1983 these countries utilized the following percentages of their hydro power resources: Bulgaria -- 26.9 percent, Hungary -- 5.5 percent, the GDR -- 75 percent, Poland -- 27.2 percent, Romania -- 25 percent, the USSR -- 16.5 percent, and Czechoslovakia -- 42.2%. In the next 10-15 years the countries in the commonwealth (especially Hungary, Poland, Romania and the USSR) intend to substantially increase the use of their hydro power potential and simultaneously increase the construction of GAES. The comprehensive use of water resources, taking into account solutions to problems of inland shipping, water supply, irrigation and other uses will remain one of the basic directions in hydro power construction.

A number of power projects and engineering facilities have been built, are being built and will be built in accordance with the scheme for the comprehensive use of the water resources of the Danube. There are also subsequent projects implemented by interested CEMA countries within the framework of the Standing Commission. In addition to revealing the potentials of the Danube, the hydro power resources of other rivers were also estimated.

Some work was directed towards improvements in operating GES, the substantiation of design decisions, the development of progressive calculations and designs for water resources engineering installations and assuring their reliability. There was also scientific work on optimizing the use, operation and management of GES and GAES within an OES and taking development prospects into account.

Joint research results were used in the construction of the Chaira GAES and Devin GES (Bulgaria); the Dregan and Bradishor Dams (Romania); and the Toktogul, Inguri, Nurek, Chirkeyska and Rogunskaya GES (USSR).

It seems advisable that among the long term problems in CEMA countries' hydro power development one should distinguish the following questions: further improvements in the efficiency of operating GES; the comprehensive use of hydro power resources, including planning studies to find locations for energy complexes which include AES-GAES and AES and GES - GAES; the development of new hydro power machinery materials with increased cavitation and fatigue resistance; the assessment and use of economically feasible hydro power

potentials of small rivers (which, according to preliminary estimates, make up about 10 percent of total CEMA countries hydro power potential).

One should note the great urgency of joint developments and exchange of experience in studying and using small rivers. This is very important for the USSR because 15-20 years ago there was a stop to the planning and construction of small GES and to research and production of hydro power equipment for them. At the same time a number of fraternal countries (for example Czechoslovakia, Bulgaria and Romania) developed progressive engineering solutions and built new types of hydro power equipment and control and automation systems improving the economic efficiency and reliability of small GES. CEMA organs are now expanding work in this area, in particular, in assessing the possibility of building standardized equipment for small GES with maximum levels of automation, in the discovery of rational arrangements and designs to reduce the unit cost and material intensiveness of such GES and to industrialize their construction.

The interconnection of national electric power systems for parallel operation is one of the main directions in the development of the international socialist division of labor in CEMA countries electric power engineering. The possibility and effectiveness of its organization (implemented mainly during 1959-1967) were determined by the concentration of electrical energy generation, the centralization of its supply, the growth in the distance and voltage of national system transmission lines, the striving to more fully use the advantages inherent in a transition from the isolated operation of individual power plants and groups of them to their joint functioning within electric power engineering systems. A substantial influence was also exercised by the growth in the exchange of electrical energy between CEMA countries energy systems (in the beginning stages between their border regions) and the formation of a network of intersystem and intrasystem lines.

An international organization -- the Central Dispatch Administration (TsDU OES) was set up in Prague in 1962 in order to more completely use the technical and economic advantages of OES parallel operation and to coordinate the actions of national state dispatch administrations on the basis of the agreement signed by the governments of Bulgaria, Hungary, the GDR, Poland, the USSR and Czechoslovakia. By the end of 1983 these countries were linked together, and with Yugoslavia, by 31 intersystem lines (including 3 two circuit lines). There are one 750 kV line, 12 400 kV, 10 220 kV and 8 110 kV lines. There are also a 220 kV line from Hungary and Czechoslovakia to Austria, one from Bulgaria to Turkey and a 440 kV line CSSR-Austria line. The reliable parallel functioning of CEMA countries OES requires the development and implementation of a number of organizational, technical and economic measures, including those to increase the economic stimulus to maintain agreed upon conditions and to assure sufficient capacity of intersystem lines and internal networks.

In addition to planned deliveries, the exchange of electrical energy between national systems with parallel operating line should also provide for flows in emergency situations, weather problems hindering system operation, differences in daily and annual peak loads and reductions in capacity

reserves. These factors are the basis of the economic effects from OES parallel operation. In December 1983 the effect from the integration of peak loads was about 3,200 MW.

In 1983 the exchange of electrical energy between countries participating in the TsDU was 35.6 billion kw, this was 2.8 billion kWh more than in 1982. More than 50 percent of this was from from the USSR. The export of electrical energy from the USSR to CEMA countries is growing: during 1966-1970 it was 14 billion kWh; in 1971-1975 -- more than 40, in 1976-1980 -- 64 and in 1981-1983 -- 54 billion kWh. As was noted at the CEMA countries Economic Summit Conference, the growth in deliveries of electrical energy (and natural gas, with the simultaneous continuation of deliveries of other energy carriers and many types of raw materials) makes it essential that economic conditions be created in the importing countries which assure compensating deliveries of needed goods to the USSR.

The parallel operation of OES permits the more rational use of various types of electric power plants and improves the economic efficiency of the fraternal countries' power engineering bases. It has also made it possible for them to build large electric power plants and to use large capacity units. At the beginning period, the OES had only two 200 MW units, while in 1983 there were 295 units of 200 MW and more each.

The Standing Commission is working on and has already completed a number of research projects directed towards improving the parallel operation of OES in CEMA countries, the operation of electrical facilities and improving electric power system reliability.

In preparing the Concepts for the long term development of electric power engineering in CEMA countries OES up to the year 2000, there is also an examination of questions of possible cooperation with integrated power systems in Western Europe. At present, the exchange of electrical energy between Eastern and Western Europe takes place through the delineation of a region in one of the CEMA countries to work in a "peak condition" or the use of direct current deliveries (between energy systems in the USSR and Finland or Czechoslovakia and Austria). It is assumed that such exchanges will increase in the long term. At the 12th Congress of the World Power Engineering Conference in Deli (1983), materials from the Secretariat of the UN European Economic Commission indicated the possibility of increasing the electrical energy imports of Western European countries to 6-9.6 billion kWh and noted the effectiveness of organizing intersystem ties (in particular to have balanced exchanges of electrical energy, including that based on the use of intersystem effects, over a given period). There are also prospects for further increases in direct current deliveries.

The tasks facing CEMA countries power engineering over the next 10-15 years determine the main directions of scientific-technical collaboration in this area. First priority is given to questions of rationalizing and improving the efficiency of fuel and energy use in the sector, expanding the use of local fuel and energy resources, including low heating value fuel, further

expansions in CEMA country OES parallel operation and improvements in its efficiency (for example, through improvements in the technical and economic means of managing it).

Work will continue on measures directed towards improvements in existing and the development of new progressive equipment for nuclear power plants (including improvements in VVER-type [water-cooled] reactors, research on technological processes at AES with fast reactors and questions concerning the creation of thermonuclear installations), hydro and heat and power engineering (including steam-gas and magnetohydrodynamic equipment).

Attention will be concentrated upon joint research on the creation of energy conserving and waste free technology which could perceptibly improve the economies of generating and distributing electrical energy and meet ecological demands

Because of the limited reserves of organic fuels and the growing costs of extracting and transporting them, in recent decades an important place has been given to the search for possibilities of using new sources of energy, above all renewable ones.

In order to concentrate efforts in the most important directions, the CEMA country Economic Summit of CEMA countries provisionally worked out the Comprehensive Program for Scientific-Technical Progress over the next 15-20 years. It was stressed that this should become a long term program of action in science, technology and production with specific targets and deadlines and the essential support resources. The Program reflects basic problems in science and technology, including nuclear power engineering. In elaborating it use will be made of CEMA organs' scientific and technical forecast for solutions to fuel and energy problems in the fraternal countries up to 2000 and beyond.

The realization of the contractual agreements on paths for solving fuel and energy problems made at the CEMA countries Economic Summit is definitely important to the forward development of the national economies of the socialist countries. The 38th (extraordinary) and 39th CEMA Sessions approved a set of organizational measures and on their basis worked out specific long term measures to implement these contractual agreements. Their prompt fulfillment, the effectiveness of which could be substantially strengthened by using progressive forms of collaboration, is a first priority task for CEMA countries and organs of the Council for Mutual Economic Assistance.

#### FOOTNOTES

1. "Ekonomicheskoye soveshchaniye stran -- chlenov SEV na vysshem urovne, 12-14 Yunya 1984" [The CEMA Economic Summit -- 12-14 June 1984], Moscow, Politisdat, 1984, p 22.
3. Because the unit energy intensiveness of specific types of production, and consequently, economies in general has objectively differing dynamics in individual countries at various stages of development, the direct

comparison of the unit energy intensiveness of national income in, for example, the CEMA countries and industrially developed capitalist countries, determined by specific conditions and natural peculiarities, is very conditional. In economic periodicals one often sees the statement that energy intensiveness is about 30-50 percent lower in the capitalist countries.

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